



REPRESENTING DATA

Session 3

Topic	Activity Name	Page Number	Related SOL	Activity Sheets	Materials
Representing Data	Line Plots	67	7.17, 7.18	Vocabulary Terms, Line Plots, Construction of Line Plots, What's In Your Box of Raisins?	Transparency, markers, one box of raisins per participant
	Stem-and-Leaf Plots	73	5.18, 6.18, 7.17	Age of Teachers' Children, Data from Math Classes	Transparencies, overhead transparency markers, sticky notes in two colors, chart paper, markers
	Box-and-Whisker Plots	79	5.18, 6.18, 7.17, 8.12	Vocabulary, Assessing Box and-Whisker Plots, Vocabulary Signs	Vocabulary terms on word cards, overhead markers, 3 x 5 index cards, yarn, scissors, digital camera
	Ham and Cheese Please (Coordinate Graphs)	88	4.18, 7.12		Two colors of tape, coordinate cards
	Find the Mole Hole (Coordinate Graphs)	89	4.18, 7.12	Mole Hole Grid	
	Graph Paper Warfare (Coordinate Graphs)	91	4.18, 7.12	Graph Paper Warfare Grid	
	Scattergrams	93	7.17, 8.12	Recording Sheet, Idea Sheet	Measuring tapes, graph paper
	Graph Detective	97	1.19, 2.23, 3.22, 4.20, 5.18, 6.18, 7.18, 8.12	Would You Draw the Same Conclusion?	



Activity: Line Plots

Format: Large Group; Pairs

Objectives: Participants will construct and compare line plots, and discuss data distribution using these plots.

Related SOL: 3.21, 7.17, 7.18

Materials: Blank transparencies, overhead pens, blank paper, Vocabulary Terms Activity Sheet, Line Plots Activity Sheet, Constructing Line Plots Activity Sheet, What's In Your Box of Raisins? Activity Sheet, small box of raisins for each participant

Time Required: 30 minutes

Background: A line plot is a graph that shows each item of information on a number line. It has the shape of a bar graph. A line plot is often used to show the spread of the data. You can quickly identify the range, the mode, and any outliers of the data.

Graphs that show data distribution (data groupings) are usually called plots. This is because you show individual data points and not bars or connected lines. These graphs can be used to illustrate how some events are related to other events (age to height) or whether data tend to bunch together or spread out. Words used to describe data distributions are listed and defined in the following vocabulary section.

U-shaped – data that have large clusters of points at both ends and few points in the middle

Normal – data that assume the shape of a bell curve with few data points at either end building to many points at the center

Skewed – Data can either be **right skewed** by beginning with few data points and gradually rising to many data points or **left skewed** by beginning with many data points and gradually descending to few data points.

Bi-modal - Data that contain two distinct modes of equal height. Data containing three distinct modes are called **tri-modal**.

**Directions:**

1. Distribute Construction of Line Plots Activity Sheet to participants. Construct a line plot of the number of letters in the first name of each participant on the blank transparency. Briefly discuss how to construct a line plot (Construction of Line Plots Activity Sheet). Ask participants to discuss what they notice about the data (the range, median, and mode(s) of the data).
2. Using the line plot on the transparency, discuss the data display. Use the shape of the plot to introduce the idea of data distribution asking such questions as “What shape does the line plot have?”
3. Discuss the data distribution vocabulary on the Activity Sheet. Discuss the meaning of the terms and sketch the shape each might take. Use the Sample Line Plots Activity Sheet to display sample data distribution of line plots.
4. Give each participant a box of raisins. Have them predict the number of raisins in the box. Do a line plot of their predictions on the What’s In Your Box of Raisins Activity Sheet. In this case, the instructor must first ascertain the range of the data and then plot the points. Discuss outliers if a participant predicted a number significantly greater than other participants. Next, ask the participants to open their boxes and count the raisins. Have the participants construct a line plot on their What’s in Your Box of Raisins Activity Sheet as each participant shares the number of raisins in his/her box. As the participants construct their line plots, construct the same plot using the Activity Sheet.
5. Conclude by discussing the distribution using the previously defined vocabulary. Have the group brainstorm the kinds of data that might show the different data distributions (e.g., average daily temperature in Atlanta from August to July should show a U-shaped distribution).



Vocabulary Terms

Line Plots

U-shaped-

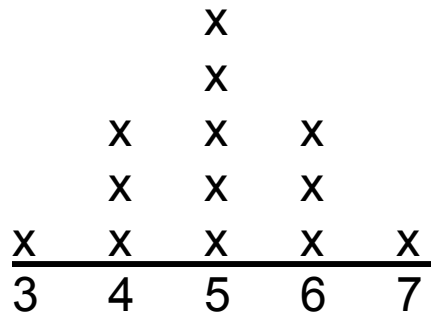
Normal-

Skewed-

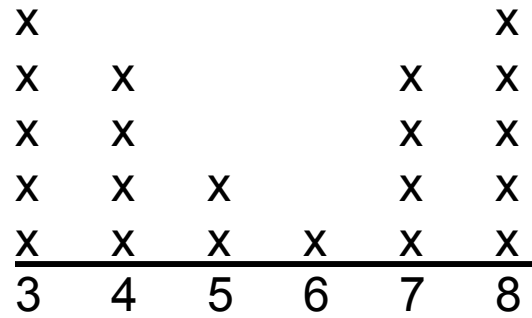
Bi-modal-



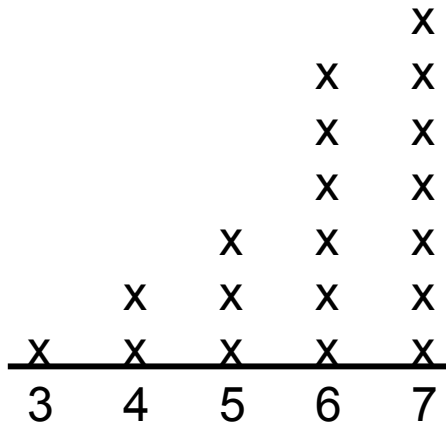
Line Plots



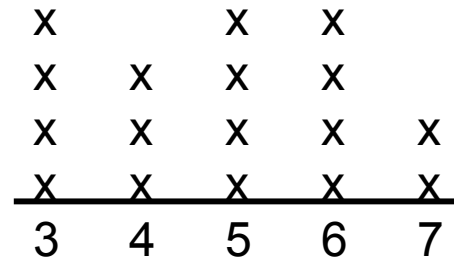
normal



U-shaped



right skewed



tri-modal



Constructing Line Plots

A line plot is a graph that displays the location of the data points along the segments of a number line. There is a one-to-one correspondence between the number of points on the graph and the number of collected data points. For any given value, the number of data points is represented by the number of “marks” written above the numbered segment on the number line.

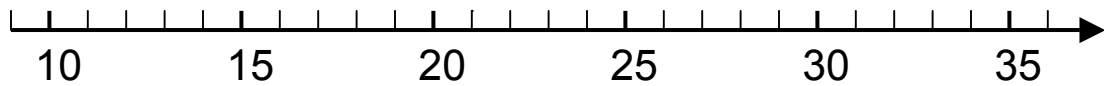
To develop a line plot, follow these steps.

- Step 1 Find the largest and smallest values in the data set.
- Step 2 Draw a number line that includes these values. Be sure the number line extends past the smallest and largest values.
- Step 3 Label the number line with a scale. Place a “mark” (usually an x or a dot) on the real number line that represents each data point.
- Step 4 Title the graph.
- Step 5 Look for the patterns in the data and make statements about the data set. Consider things such as the shape of the data (the distributions), the median, range, modality, etc.



What's In Your Box of Raisins?

Line Plot



**Activity:** Stem-and-Leaf Plot**Format:** Large group; Pairs**Objectives:** Following a discussion of the stem-and-leaf plot, participants will work in pairs to collect data. The data will then be graphed by the whole group. Participants will again work in pairs to construct back-to-back stem-and-leaf plots comparing test data from two classes.**Related SOL:** 5.18, 6.18, 7.17**Materials:** Blank transparencies (5 or more), overhead transparency pens, small post-it notes in two colors, Background Information Activity Sheet, Copies of Test Data Activity Sheet, Test Data Activity Sheet, Stem-and-Leaf Plot Activity Sheet, chart paper, magic markers, clock with second hand (optional)**Time Required:** 30 minutes**Background:** A stem-and-leaf plot is a useful way to display data that range over several tens (or hundreds). The stem represents the tens and the leaves represent the ones. Each number is represented by one stem and one leaf.

Students surveyed fifth grade teachers at Ames School to find out the ages of their teacher's sons and daughters. The results of this survey are displayed on the stem-and-leaf plot below.

Ages of Fifth Grade Teachers' Children

0	2
1	0, 4, 5, 5
2	3, 6
3	9

key: 2 | 3 = one child age 23

As shown in the plot, the fifth grade teachers have a total of eight children ranging in age from 2 to 39 years. The median (15) and mode(s) (15) of the data are displayed on the stem-and-leaf plot and can easily be determined. Clusters can be identified; for instance, more teachers have teenagers than toddlers.



Two sets of comparable data can be displayed on a back-to-back stem-and-leaf plot.

Ages of 6 th Grade Teachers' Children		Ages of 5 th Grade Teachers' Children
9, 7, 6, 5, 4, 3, 1	0	2
6, 4, 2	1	0, 4, 5, 5
	2	3, 6
	3	9

Students can compare the information presented; find the range, mean, median, and mode; locate clusters; and make inferences such as the fact that 6th grade teachers' children are younger than the fifth grade teachers' children.

Directions:

1. Use a transparency of "Ages of Teachers' Children" to go over background data with the whole group. Be certain to include:
 - Each number is represented by a combined stem and leaf. Each leaf may contain only one digit, but a stem may contain more than one digit. For example, 123 would be represented by a stem of 12 and a leaf of 3.
 - The leaves are arranged from the stem outward and are in numerical order.
2. Have the participants pair up to collect data on how long each can hold his or her breath. Give each participant one color-coded post-it note. (The colors will be used for demonstrating an easy way to divide data into two groups. For example, you can give males one color and females another or you can give fifth and sixth grade teachers one color and seventh and eighth grade teachers another.) Have each participant time how long their partner can hold his or her breath, recording that number on the appropriate post-it note.
3. Collect the post-it notes and arrange them all by decades. Using a blank transparency, construct a stem-and-leaf plot using the data collected. Follow the model in the Background Information.
4. Briefly, have the participants discuss with their partner what they see on the plot. Have them share their ideas. Be certain to discuss:
 - All the data is visible on a stem-and-leaf plot.
 - It is easy to find the range and mode(s) of the data just by looking. This would be an appropriate time to introduce the terms "bimodal"



(having two modes) and “trimodal” (having three modes) as it often happens in this type of data collection.

- Share finding the median of the data by counting. Remind the participants that, when starting with the largest number, one must count backward to find the median.
 - The mean can be found in the normal manner.
 - Discuss any other interesting clusters or trends that the group sees.
5. Discuss using two sets of comparable data to construct back-to-back stem-and-leaf plots. Dividing the data into two sets by using the color-coded sticky notes makes this an easy task. Use another blank transparency and five or six pieces of data from the two colors of notes to quickly construct a sample of a back-to-back plot showing the participants how to collect the information on one stem-and-leaf plot and then reorganizing it on another.

Example:

record

stem	leaf
3	5,3,7
2	1,8,4,7

reorganize

stem	leaf
3	3,5,7
2	1,4,7,8

6. Give each pair of participants a copy of the grade data from two math classes. Have them construct a back-to-back stem-and-leaf plot from the data. Have them briefly analyze what they found prior to a whole group discussion.
7. Use a transparency of the grade data to share the measures of central tendencies for each class. Have the participants analyze the data discussing such things as why one class may have done better than the other.
8. Have the whole group brainstorm suggestions for question stems that could be represented on stem-and-leaf plots such as hopping on 1 foot for 30 seconds and using data from other sources.



Ages of Teachers' Children

Data Set for 5th Grade Teachers:

2, 10, 14, 15, 15, 23, 26, 39

Stem-and-Leaf Plot

Ages of Fifth Grade Teachers' Children

0	2
1	0, 4, 5, 5
2	3, 6
3	9

key: 2 | 3 = one child age 23

Back-to-Back Stem-and-Leaf Plots

<u>Ages of 6th Grade Teachers' Children</u>		<u>Ages of 5th Grade Teachers' Children</u>
9, 7, 6, 5, 4, 3, 1	0	2
6, 4, 2	1	0, 4, 5, 5
	2	3, 6
	3	9





Data from Math Classes

The following are scores obtained by two classes of 25 fifth grade students on a math test. Compare the two sets of scores by using back-to-back stem-and-leaf plots. What conclusions might you draw by studying the data displayed in this way?

Class A 73 75 42 93 88 62 62 37 73 76
 96 54 80 75 69 66 81 79 83 56
 69 88 80 52 59

Class B 65 80 67 80 87 44 82 71 91 93
 75 76 79 80 87 83 54 56 57 82
 62 69 75 80 91

Class B		Class A
	3	7
	4	2
4	5	2, 4, 6, 9
7, 6, 4	6	2, 2, 6, 9, 9
9, 7, 5, 2	7	3, 3, 5, 5, 6, 9
9, 6, 5, 5, 1	8	0, 0, 1, 3, 8, 8
7, 7, 3, 2, 2, 0, 0, 0, 0	9	3, 6
3, 1, 1		
range - 49		range - 59
median - 79		median - 73
mode - 80		mode - 62, 69, 73, 75, 80, 88
mean - 74.64		mean - 70.72



Activity: Box-and-Whisker Plots

Format: Whole Group/Small Groups/Pairs

Description: Following a brief discussion of the term median, the vocabulary listed below, and box-and-whisker plots, data will be gathered from the whole group. A human box-and-whisker plot will be constructed from the data. Small groups will then work together to compare two box-and-whisker plots as a sample assessment item.

Objectives: Participants will have a model for showing students what a box-and-whisker plot looks like and how to construct it. Participants will be able to construct a box-and-whisker plot using a set of data.

Related SOL: 5.18, 6.18, 7.17, 8.12

Materials: Large picture of a cat or tiger (optional), vocabulary terms on word cards, overhead marking pens, 3 x 5 cards (one per participant), thick craft yarn, scissors, 6 signs with string to hang around the necks of students. The signs will have the following labels: median, lower extreme, upper extreme, lower quartile, upper quartile, and interquartile range (masters are included). Line on the ground (tape on the floor, chalk on concrete, line in the tile, etc.), Polaroid camera or video camera (optional), blank transparency, copies of worksheet - Assessing Box-and-Whisker Plots (1 per participant)

Time Required: 45 minutes

Background: A box-and-whisker plot is a type of graph used to represent data. It is most appropriate when you want to show the median, first and third quartiles, and least and greatest of a set of data. The “box” is like a cat’s face and the “whiskers” are formed by the data that extend out from the box. There is specialized vocabulary when using box-and-whisker plots.

Vocabulary: **Median:** the middle item in a set of data listed in numerical order; for an even number of items, the median is the average of the two middle items

Lower Extreme: the smallest numerical piece of data in a set



Upper Extreme: the largest numerical piece of data in a set

Lower Quartile: the median of the lower half of the data; the point that separates the first and second quartiles

Upper Quartile: the median of the upper half of the data; the point that separates the third and fourth quartiles

Interquartile Range: the data included in the second and third quartiles; the data encompassed within the “box”

Directions:

1. Go over the vocabulary for this topic using a transparency of the vocabulary and writing in the definitions. If you have a picture of a cat or tiger, briefly show how the face forms a box with the whiskers coming out the side.
2. Set the context by telling the participants we want to find the “average” number of letters in the first and last names of the participants in the group in order to decide what to charge for class t-shirts. The manufacturer charges per letter to personalize them, but we want to charge everyone the same rate so we will look at a way to find that rate by using a box-and-whisker plot. Have each participant write the sum of the letters in their first and last name on the 3 x 5-index card.
3. Have the participants stand and organize themselves in a line (using the line on the floor) from the least sum to the greatest. Check for proper placement and discuss any discrepancies. Have the students hold their cards in front of them.
4. Locate the pertinent points in this data set.
 - Locate the **lower extreme** (the smallest sum) and hang that sign around the neck of the person representing that point. Repeat by hanging the **upper extreme** sign around the neck of the person with the largest sum.
 - Now locate the **median** by having the lower extreme wave to the upper extreme. Continue to move to the center of the line by having each successive person from both ends of the line wave to each other. The last person to wave should be the median with an equal number of participants on both sides. (NOTE: If two students are in the middle, you need to discuss the fact that the median would be the average of these two numbers. For a first experience, it is better to plan ahead and have an odd number of participants leaving only one person to be the median. The leftover person could be the designated photographer or verifier.) Hang the median sign around the neck of the person at that point.



- Find the median of the upper half of the data by repeating the waving process, this time having the wave start with the median and the upper extreme. Label this person as the **upper quartile** and discuss the fact that this person divides the upper half of the data in two equal pieces.
 - Repeat this process to find the **lower quartile** using the median and the lower extreme. Hang the sign and discuss the fact that this person divides the lower half of the data in two equal pieces.
 - Build the box to include the interquartile range using the thick craft yarn. Start with the end of the yarn at the lower quartile and have that participant hold the end of the yarn shoulder high. Run the yarn past the median (that participant may hold on to the yarn to stabilize it) and onto the upper quartile's shoulder. Drop the yarn down to the waist of the upper quartile and have it held there. Run the yarn past the median and back to the waist of the lower quartile, and then back up to the shoulder where you started. Cut the yarn. Thus, you have made the box. Have a participant on either side of the median hold the card that says **interquartile range**. Discuss the fact that the box encloses 50%, or half, of the group. It contains the middle half of all the data.
 - To create the whiskers, tie a piece of yarn to the center of one side of the lower quartile end of the box and run it to the lower extreme. Cut the yarn and repeat this process from the upper quartile to the upper extreme.
 - If a camera is available, take a picture of the final box-and-whisker plot so the participants can have the whole picture of what they made.
5. Use the blank transparency and the data collected to construct an accurate box-and-whisker plot. Use equal intervals for each sum along a line on the transparency. Have the participants help you reconstruct what was done to create the human box-and-whisker plot as you recreate the plot on the transparency.
 6. Compare the human box plot with the one on the transparency. How do they compare? How do they differ? (Elicit that each person representing a piece of data had his or her own space in the human box plot. In the actual box plot, data with the same sum shared a point on a line, thus compacting the data. All the quartiles of the human box plot appear to be the same size, while on the actual plot their sizes may differ even though each quartile contains the same number of sums.)



7. With the whole group, brainstorm other scenarios for collecting data and constructing box-and-whisker plots. Some suggestions might include cost of CDs or some other item that students this age purchase or scores on a set of test papers. Add question stems to the charts from Session I Posing Questions.
8. Have participants form pairs and give each person a copy of Assessing Box-and-Whisker Plots Worksheet. Have them discuss the two box plots on the sheet. Then have each complete the paragraph as directed on the worksheet.
9. Reform small groups by combining two pairs. Have participants share their paragraphs in small groups and discuss how the paragraphs might be assessed.
10. Conclude the session with a summary and a short question and answer period.



Vocabulary

median –

lower extreme –

upper extreme –

lower quartile –

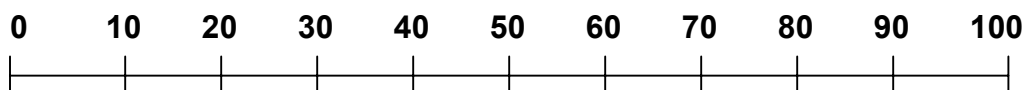
upper quartile –

interquartile range –



Assessing Box-and-Whisker Plots Worksheet

The following box-and-whisker plot represents the test scores for students in two different classes:



Class A



Class B



Write a paragraph comparing how these two classes did on this test. Give as much information as you can.



median

lower
extreme

upper
extreme



lower quartile

upper
quartile



interquartile range



Activity: Ham and Cheese, Please!

Format: Pairs

Objectives: Participants locate points on a coordinate grid.

Related SOL: 4.18, 7.12

Materials: Tape, 4 x 6 index cards labeled with coordinates

Time Required: 10 minutes

Directions:

1. Lay out a coordinate grid on the floor using two different colors of tape – one for the horizontal lines and the other for the vertical lines.
2. Make a set of coordinate cards, enough for one card for every two participants. Each card has an ordered pair. Make a matching set of cards so that every point appears on two cards.
3. Divide the group in half – one group is Ham and the other is Cheese. Give each Ham member a coordinate card from one set of cards. Remind them not to tell or show their coordinate to anyone. When directed, have the Hams move to the correct location on the floor grid.
4. Give each Cheese member a coordinate card from the matching set. Have the Cheese members try to guess which Ham will be their partner. When directed, have the Cheese members find their matching Ham.
5. Partners have now been established for other activities.



Activity: Find the Mole Hole

Format: Pairs

Objectives: Participants play a game to locate a hidden Mole Hole by making educated guesses on a coordinate grid.

Related SOL: 4.18, 7.12

Materials: 10 x 10 coordinate grid - one per student per game, colored pencils

Time Required: 10 minutes

Directions:

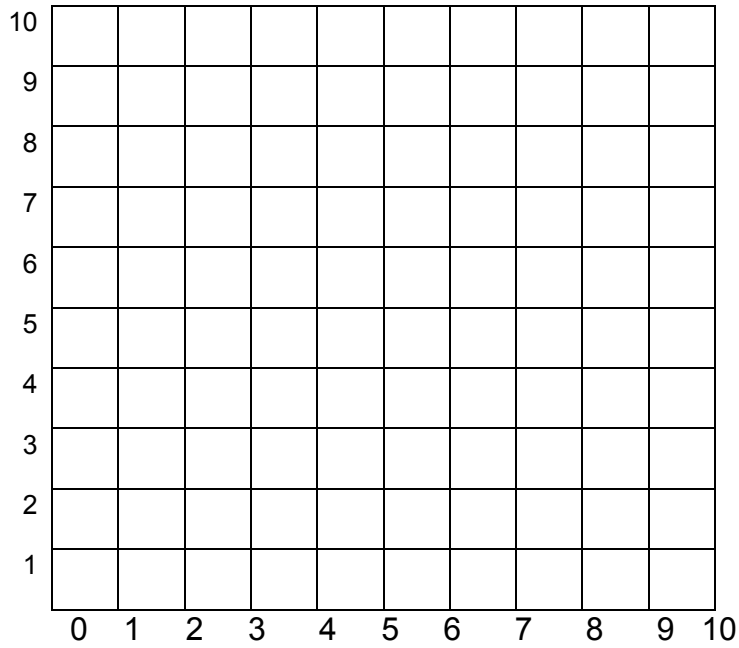
Explain these rules:

1. The goal is to find the Mole Hole in the least number of guesses.
2. One student is the MOLE and the other is the EXTERMINATOR. The MOLE makes a row of 5 points, horizontally, vertically, or diagonally, on his/her coordinate grid but does not show the secret row to the EXTERMINATOR. The secret row is the Mole Hole.
3. The EXTERMINATOR looks for the Mole Hole by naming points on the grid one at a time. The MOLE says “yes” or “no” to tell whether a named point is on the Mole Hole.
4. If a point is not on the Mole Hole, the EXTERMINATOR keeps guessing until he/she names a point on the Mole Hole. Once a Mole Hole point is found, the EXTERMINATOR has a clue to the location of the Mole Hole. The EXTERMINATOR uses strategy to name the other points that mark the entire Mole Hole.
5. The EXTERMINATOR uses his/her own grid to keep track of his/her guesses. This will help the EXTERMINATOR plan better guesses and avoid repeating points. Have pairs take turns as MOLE and EXTERMINATOR.
6. Winner is the partner who found the mole hole in the least number of guesses.



MOLE HOLE GRID

MOLE's GRID



Coordinates called:

(,) (,) (,)

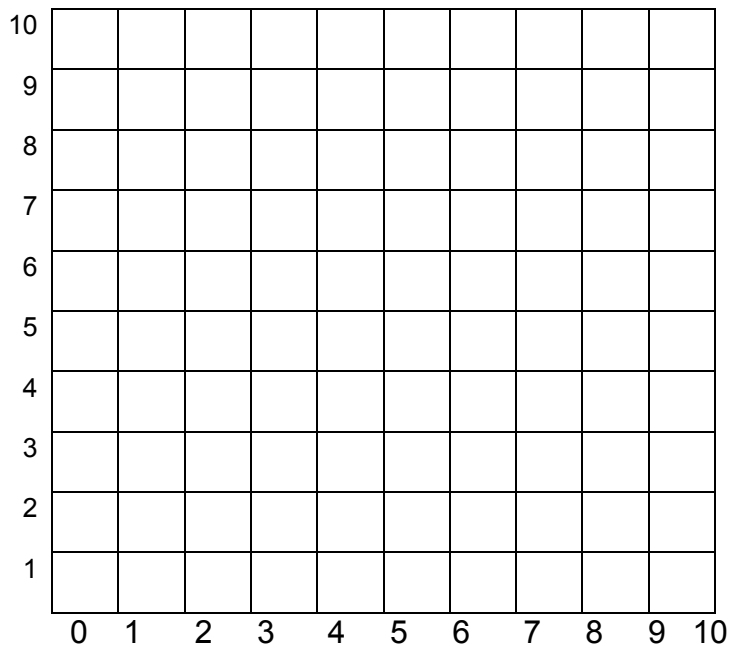
(,) (,) (,)

(,) (,) (,)

(,) (,) (,)

)

EXTERMINATOR's GRID



Coordinates called:

(,) (,) (,)

(,) (,) (,)

(,) (,) (,)

(,) (,) (,)



Activity: Graph Paper Warfare

Format: Pairs

Objectives: Participants find points on a coordinate grid in preparation for scattergrams.

Related SOL: 4.18, 7.12

Materials: Graph paper – 1 sheet per student per game, colored pencils or markers

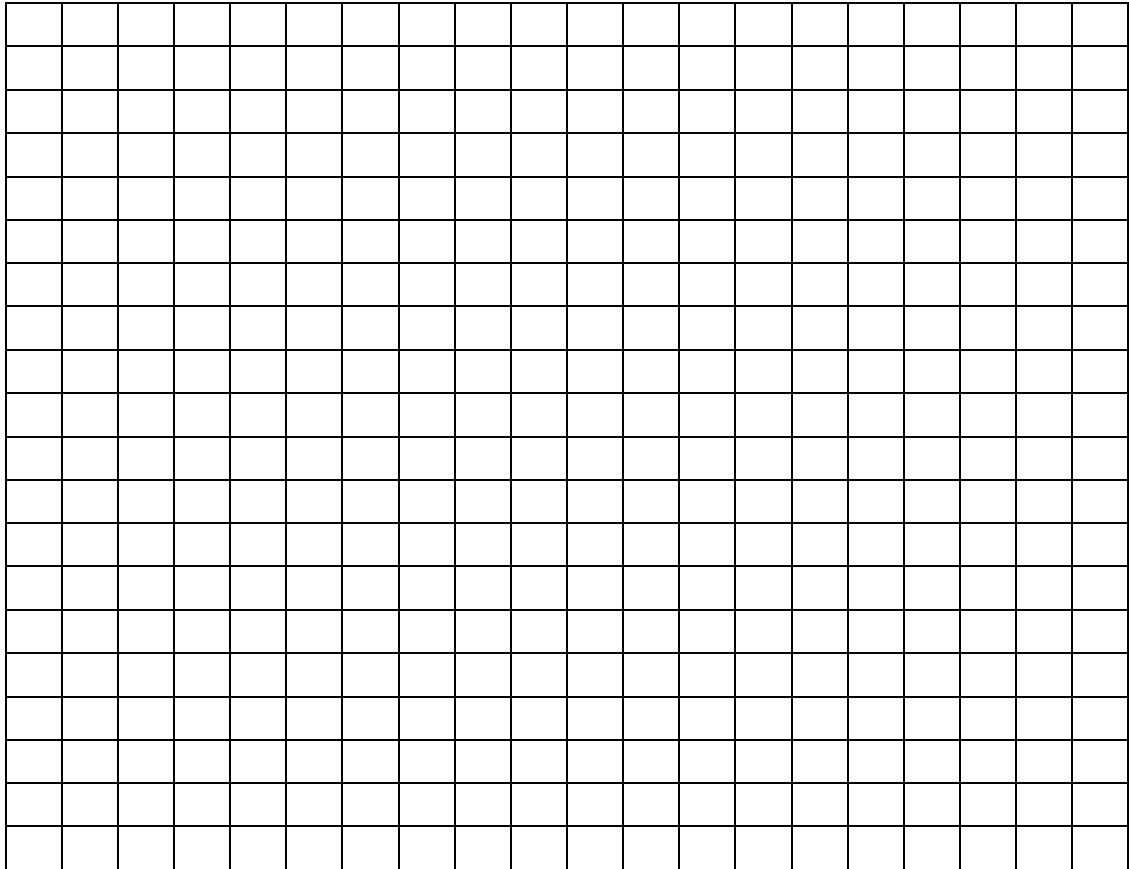
Time Required: 15 minutes

Directions:

1. Each player will locate 1 battleship, 2 destroyers, and 2 submarines on his/her grid. Ships may be placed horizontally, vertically, or diagonally. Ships may not overlap. Ships are defined as follows:
 - 1 battleship – 6 consecutive points in a row;
 - 1 destroyer – 4 consecutive points in row;
 - 1 submarine – 3 consecutive points in a row.(For younger players, fewer ships may be used and locations of ships restricted to Quadrant I)
2. Player 1 (determined by a quick round of “Paper, Scissors, Rock”) calls a coordinate believed to be a coordinate of part of a ship. Player 1 should record the coordinate called on his grid in a color different than the color of his own ships.
3. Player 2 responds with “Hit”, if the given coordinate is part of a ship, and announces type of ship hit; or “Miss”, if it is not a part of the ship.
4. If a Hit is scored, Player 1 calls a second coordinate and Player 2 again responds. If a Miss is scored, play goes over to Player 2 who calls a coordinate. Player 1 then responds with “Hit” and the type of ship struck, or “Miss”.
5. Play continues in this fashion until an entire fleet is sunk.
NOTE: For a ship to be considered sunk, all coordinates containing the ship must be called.
Variations: Adjusting the size of the grid paper and/or the number or size of the ships can shorten or lengthen the game play.



Graph Paper Warfare Grid





Activity: Scattergrams

Format: Small group

Objective: Participants will use scattergrams to analyze relationships in data.

Related SOL: 7.17, 8.12

Materials: Graph paper, measuring tape, recording sheet, graphing calculator (optional)

Time Required: 30 minutes

Background: A scattergram, which is also called a scatter plot, suggests whether or not two sets of data are related. The data are graphed as a collection of ordered pairs of numbers (x, y). Whenever you graph two sets of data as ordered pairs, you make a scattergram.

To determine if the data in a scattergram are related, pretend that a line is drawn so that about half the points in the scattergram are above the line and about half are below.

If the y-coordinates tend to increase as the x-coordinates increase, then x and y have a positive correlation. If the y-coordinates tend to decrease as the x-coordinates increase, then x and y have a negative correlation. If no pattern exists between the coordinates, then x and y have no correlation. In general, if the line between the points slants up and to the right, there is a positive relationship. If the line slants downward and to the right, there is a negative relationship. If no line is apparent, there is no relationship.

Directions:

1. Pose the question: Do you think there is a relationship between a person's arm span and a person's height?
2. Each group should use a measuring tape to measure the height and arm span of each person in the group. Measurements may be in inches or centimeters. To measure arm span, lift both arms to shoulder height and measure from fingertip to fingertip across the back.
3. Record the value of each person's measurements in the chart on the worksheet.



4. Send a “runner” to each of the other groups in the room and record their data on the worksheet.
5. Graph the data on a coordinate plane. Label the horizontal axis “Height” and the vertical axis “Arm Span”.
6. Draw a trend line. What kind of relationship does the trend line show? (As an extension, a graphing calculator could be used to determine the line of best fit for the data.)





Additional Ideas for Determining Positive, Negative, or No Correlations

- height and shoe size*
- salary and shoe size
- year and winning time at the Olympics
- student study time and test scores*
- age and value of a family car
- student's height and test scores
- height and age of a pine tree
- number of pets owned and your age
- number of hours of TV watching and test score
- number of trees in a small park and the temperature on a summer day
- weight and speed in a foot race
- test scores and shoe size*
- amount of education and annual salary*
- washing the car and rain fall
- outdoor temperature and layers of clothing
- eating nutritious food and being healthy
- speed of typing and the number of pages to be typed
- area of a soccer field and height of the grass
- age and height*
- age and value of antiques
- school attendance and grades*
- watching the news and scores on a current events quiz
- practicing basketball and the ability to play well
- taking a school bus and completing homework
- wrist and shoe size*

*These topics might prove very interesting when the data are collected and graphed in a scattergram.



Activity: Graph Detective

Format: Pairs or small groups

Objectives: Participants will apply the skills they learned from the previous activities to analyze graphs for missing attributes.

Related SOL: 1.19, 2.23, 3.22, 4.20, 5.18, 6.18, 7.18, 8.12

Materials: Set of graphs with missing information

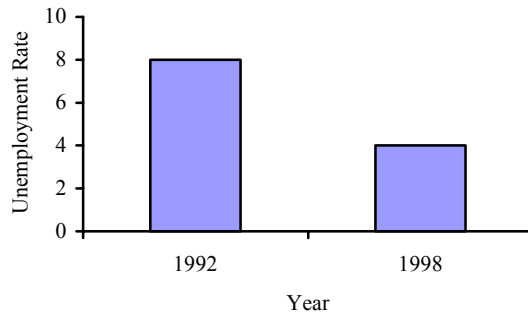
Time Required: 20 minutes

Directions:

1. To wrap up the session, give each group a set of three graphs and conclusions and ask them to discuss whether the conclusion is accurate and what factors about the graph may have lead to inaccurate conclusions. Key factors in the misleading graphs include the following:
 - Graph 1: Missing years – A trend cannot be seen by examining only two years. *USA Today* uses a lot of these graphs to compare two years. This graph compares unemployment in 1992 and 1998. Although 1998 may be lower than 1992, we should not assume that 1999 will be lower than 1998 or that the trend between 1992 and 1998 was downward. We need to see the other years to determine if there is a trend over time or if 1998 is a fluctuation.
 - Graph 2: Broken scales – Often graphs imply larger differences than are true because the scale is broken. In this graph, because the scale is broken, it appears that there were twice as many births in July than there were in June.
 - Graph 3: Size Distortions – Picture graphs using objects to demonstrate change can be misleading because the size of the objects may not truly represent the relative numerical value. This graph shows the relative earnings of men and women. Women earn approximately 70¢ for every dollar that men earn; yet, the graph implies that men earn nearly three times as much as women because of the relative size of the three-dimensional bars.

Would You Draw the Same Conclusion?

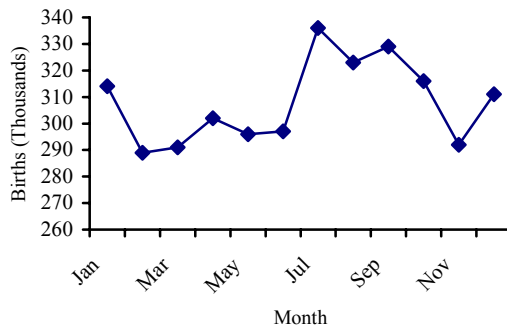
Unemployment Rates (1992 - 1998)



Conclusion: Unemployment rates have fallen steadily since 1992 and will continue to fall in the near future.

Group's Conclusion:

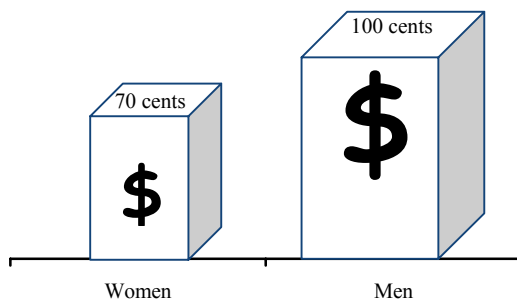
Number of Births per Month



Conclusion: The number of births doubled between June and July.

Group's Conclusion:

Earning Power of Men versus Women



Conclusion: Men make almost three times as much as women. The bar for men has nearly three times as much volume.

Group's Conclusion